DOCUMENT RESUME

ED 432 603 TM 029 985

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TITLE Vicarious Learning: Cognitive and Linguistic Effects of Observing Peer Discussion.
PUB DATE 1999-04-00
NOTE 13p.; Paper presented at the Annual Meeting of the American Educational Research Association (Montreal, Quebec, Canada, April 19-23, 1999).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Cognitive Processes; *Dialogs (Language); Foreign Countries; *Graduate Students; Graduate Study; Higher Education; *Learning; *Observation; *Peer Influence; Peer Teaching
IDENTIFIERS *Vicarious Participation

ABSTRACT

The Vicarious Learning project is aimed at understanding the role of dialogue in learning about complex conceptual domains. The fundamental assumption of "vicarious learning" is that students can receive benefits from exposure to discussions among their peers and between students and tutors. To elicit dialogues that can be captured, F. Dineen developed "Task-Directed Discussions" (TDDs) based on exercises used in teaching English as a foreign language. Students using TDDs are able to have productive discussions very quickly. Videotapes of student discussions using TDDs were used to develop a dissemination system that allows multimedia to be integrated with the primary teaching material. An experiment was run to investigate the efficacy of these "vicarious learning" resources in a controlled laboratory setting using part of a Master's level course in computers in teaching. Eighteen students used the vicarious learning materials and 18 others did not. Results show some benefits in learning and substantial positive changes in attitudes and discussion behavior for students having access to vicarious learning resources. Implications for instruction are discussed. (Contains 17 references.) (SLD)

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Vicarious Learning: Cognitive and Linguistic Effects of Observing Peer Discussions

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This paper is prepared for the:
Annual Meeting of the American Educational Research Association in Montreal Canada
April 1999

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Presented at American Educational Research Association, *AERA '99*, Montreal, Quebec, 20-23 April, 1999.

Vicarious Learning: cognitive and linguistic effects of observing peer discussions

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The Vicarious Learning project is aimed at understanding the role of dialogue in learning about complex, conceptual domains. Experience and research have shown that dialogue is an essential component of learning, particularly in complex, conceptual domains [5, 11, 16]. However, with increasing class sizes and the move toward more computer-based courses, particularly in tertiary-level and distance learning courses, this component is ever-decreasing and in some danger of disappearing completely. We believe that the role of technology should be to push back the threshold imposed by these constraints by opening up new media for discourse that are not subject to the same bottlenecks as traditional methods [10].

The fundamental assumption of 'vicarious learning' is that students can receive benefits from exposure to discussions among their peers and between students and tutors. Our aim is certainly to promote learning, but also to facilitate modeling of patterns of language in new domains. This acquisition of 'speech genres' or specialised patterns and vocabulary is an important component of learning any new domain and, we believe, one which requires exposure to language 'in use' by practitioners [17] as well to texts and other written curriculum material.

In several experimental laboratory studies and university courses, we have developed and refined our understanding of how to design, capture, store, index, retrieve and re-use educational discussions. This new type of learning resource holds out promise both for isolated or distance

learners and for students who might need greater exposure to language 'used in anger' than they are likely to get in traditional educational encounters in the classroom and lecture hall.

Our research on vicarious learning has found benefits that are both *cognitive*, resulting in an increase in knowledge and understanding in the particular curriculum area, and *social*. One social effect is that exposure to peer discussion creates positive feelings of being part of a learning community. Perhaps more importantly for our goals, we also find that students rapidly begin to model the language and structure of the discussions to which they were exposed. We think that this introduction into 'specialised arenas of language use' is precisely the type of result that we would want to foster, as well as promoting learning of new domain knowledge.

In our initial attempts to capture good learning dialogues among peers, we found, as have many researchers in the area of classroom discourse and small group interaction, that it was very difficult to get students to 'break out' of the traditional classroom situation in which a teacher asks most of the questions and structures most of the discussion, even when we followed the usual conventions and techniques for facilitating small group discussion [6]. Our goal was to encourage deep and critical discussion of difficult concepts in a domain whereas often there is very little discussion at all in classroom and tutorial situations, but more of an uncritical rehearsal of answers. Thus, having tried, and basically failed, to capture such dialogues in fairly traditional small group discussions, on-line and face-to-face, we directed our efforts at designing ways of eliciting better dialogues which could then be captured and reused by other learners.

To this end, Dineen developed a set of 'Task-Directed Discussions' (TDDs) based on exercises used in Teaching of English as a Foreign Language. The purpose of these tasks is to overcome the 'barriers of silence' found both in classrooms and on-line [1, 9, 13, 14, 15] and to allow students to discuss their emerging, nascent understanding, indeed to expose their potential *mis*understandings, in non-threatening ways. There are now a set of 11 such tasks that begin very simply and become increasingly more complex [6].

We found that students using the TDDs are able very quickly to have productive discussions about complex topics. Perhaps as importantly, they found the tasks engaging, but they remarked often that it 'really made them think'. We videotaped over 30 hours of discussions among students, and between students and an expert, using the TDDs. From primary instructional materials and integrated clips taken from these videos, we created an architecture called the *Dissemination* System that allows a multimedia database of video and audio clips, text transcriptions, and annotated graphics to be integrated with primary expository teaching material, all delivered via the Web. Using this system, an experiment was run to investigate the efficacy of 'vicarious learning' resources in a controlled laboratory setting.

EXPERIMENT

The experimental system used a portion of an on-line Masters level course in Computers in Teaching and Learning that had been taught twice before. A self-contained section on Models of Learning with Technology was extracted containing approximately 14,400 words on 45 Web pages ranging from a couple paragraphs to 1 1/2 pages in length. In addition, there were a set of 'vicarious learning' resources integrated into the on-line readings. These consisted of material

edited from the 30 hours of tapes generated face-to-face using the TDDs. This resulted in 108 video clips, 13 audio clips, 43 text transcriptions, and 27 audio annotated graphics that could be accessed either by clicking on highlighted keywords in the primary text or by searching on keywords or the type of discussion task.

Thirty-six students were divided into two groups based on their pretest scores on a knowledge test of the domain and on two questionnaires, one about their frequency of use of various types of media for learning and another on their views about various aspects of peer discussion as a useful source of learning, as well as matching for gender. This resulted in two groups of 18 who did not differ significantly on knowledge, stated media preferences, or attitude toward discussion. One group saw the Web-based primary learning material only (Notes group); the other saw the same material with the additional vicarious learning resources (Vicarious group). All the items on the knowledge tests could be done having read the primary material only.

The students spent 2 hours each day for two days in the lab studying the course notes and taking notes on paper, resulting in 4 hours to learn the material. Their paper notes were collected at the end of each session and returned to them at the beginning of the next session. The server stored information about each page or resource that was viewed, the amount of time spent on each, and in the case of audio and video files, how much of the clip was played. On the third day, the students had 40 minutes to review the on-line material and their written notes. They then filled in an HCI questionnaire about the system and a questionnaire about their learning experience followed by the knowledge posttest which was the same as the pretest.

On the fourth day, the students were divided into groups of either two or three (the same across groups) and participated in a 40 minute, on-line, synchronous discussion of the material using Internet Relay Chat. (Internet Relay Chat, for those who have not encountered it, is a system that provides a window for each participant into which they type messages. These messages are then displayed to the other members of the same chat session. The typed transcripts can be stored on the fileserver.) They were simply told to discuss the course content to clear up anything they did not understand. These discussions were saved for analysis. They then took a final knowledge posttest.

RESULTS

In this paper, we are concentrating primarily on the discussion content and somewhat on the knowledge tests. Our initial analyses indicate a number of interesting differences between the groups reflected in the way they engage in discussion.

We found that students who used the vicarious learning materials scored as highly on the final posttest as those in the Notes group, with some evidence of a tendency to larger learning gains among some of the Vicarious subjects. Also, we found significant differences in the amount of discussion generated, averaging 834 words for the Notes group and 1075 words for the Vicarious group, (Mann-Whitney $U=9.0$, $p<.04$). More importantly, when scored by a blind rater for the relevance of each statement, the Vicarious students stayed on topic significantly more than the Notes group (82% vs 68%).

Looking a bit more closely at the patterns of interaction, we examined the instances where the discussion strayed from the content of the course to unrelated topics. This generally occurred either because no one could think of more questions or topics to discuss, or because no one knew the answer to the current question. We counted the number of typed utterances between the initial one that was judged to be off-topic and the one where the group was judged to be again on topic. We found that the Vicarious had significantly shorter stretches of off-topic utterances than the Notes group as judged by the rank order of number of utterances (Mann-Whitney $U = 139$, $p<.0001$).

The summary table (Table 1) shows the number of off-topic utterances for each group when recovering from one of these instances. What is striking from this pattern is that the Vicarious group has a large number of instances in which only one or two utterances are off-topic. Either a single person interjects an irrelevant comment which is ignored by the other participants or there is perhaps one acknowledging response before the group resumes discussion of the course topics. In the Notes group, while this happens occasionally, there are far more longer stretches of irrelevant banter.

Number of irrelevant utterances	**Frequency in Notes discussions**	**Frequency in Vicarious discussions**
1	2	19
2	4	14
3	5	1
4	2	1
5	2	1
7	0	2
12	2	0
13	1	0
16	1	0
18	1	0

What is perhaps most interesting to us is that when the students engage in discussions themselves, we find that those who had seen the vicarious resources were modeling the tasks and language used in them. For instance, in Vicarious groups, when the discussants ran out of things to say on a topic, they sometimes suggested trying one of the discussion games they had seen in the resources, as in the following excerpt:

<Discussant1> OK, perhaps we could just pick a concept and try and describe it to another person.

<Discussant2> well you can go first then

<Discussant3> accretion?

<Discussant2> adding of new knowledge to existing schema, most common form of learning

<Discussant1> Accretion is the second stage in the learning process, after structuring, and it involves adding bits of knowledge into a schema

<Discussant3> ah, I see.

The students in the Notes group, when the discussion hit a lull, tended to talk about many unrelated topics: World Cup football, television, holidays, and Elvis.

Further analysis of the discussions, using a specialised markup scheme based on sources in the literature [4, 9, 12], showed for the Vicarious group significant increases ($p < 0.05$) in the number of occurrences of several educationally relevant discourse features:

1. Critical assessment of one's own or another person's contribution to discussion;
2. Justification — providing proof or examples to ground a statement;
3. Explicit derivation of new information from known facts;
4. Signalling recall or exposition of another person's argument or reasoning.

This is further valuable evidence of the power of watching dialogues to influence positively the subsequent behaviour of students in discussions.

CONCLUSIONS

In this study, and in two previous smaller ones [2, 8], we have found some benefits in learning and substantial positive changes in attitudes and discussion behaviour for students having access to vicarious learning resources. We think that this throws up a very important challenge to some other claims about learning and raises many interesting questions. Some people have claimed that learning can only take place when students are actively and personally engaged in discussion [3]. We believe that we have strong evidence that being able to observe peer dialogues can, on the contrary, provide a useful source for learning, both cognitively and socially. Indeed, we have

argued elsewhere that such vicarious learning may at times have even more benefit than being a participant, depending on the state of the learner [7].

There are many questions that still remain, however. We do think that students need to participate in 'live' discussions as well, in order both to expose their own nascent understanding and to practice the language 'in use'. It may be that this should optimally take place after they have had the opportunity to 'listen in' or perhaps it should be interleaved with the vicarious experiences. Also, it may be that this type of experience is only useful when a child has reached a certain level of maturity. While we have not yet tried looking systematically at vicarious learning with secondary or primary school students, our discussions of the research with teachers indicates that they see observation of other children as a very important source of learning and social modeling, even in very young children. There is a great deal more that could be done in looking at these questions.

FUTURE RESEARCH

Our immediate plans for the future are to continue analysing the data from the current experiment and to refine our Dissemination system in order to allow others to use it more easily for their own research and teaching. We are interested in researching more particularly the effects of "overhearing" on performance and learning. There are interesting ways in which people change their discourse when they know there is an overhearer versus when there is not, but this issue has not been much researched in relation to learning. Given that we might collect educational resources opportunistically for incorporation into a Vicarious Learning system, we are interested

in finding out whether dialogues produced in one way or another are more or less beneficial for learners.

ACKNOWLEDGEMENTS

We would like to acknowledge the contributions of Jonathan Kilgour and Richard Tobin, who implemented the Dissemination system architecture. Other members of the Vicarious Learning project are Dr Richard Cox and Professor Keith Stenning. The research was funded by grants from the Economic and Social Research Council Cognitive Engineering Programme and the Engineering and Physical Science Research Council Multimedia and Networking Applications Programme.

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